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REVISIONARY NOTES ON THE ANT GENUS
MYRMECIA OF AUSTRALIA

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No. 1.—*Revisionary Notes on the Ant Genus Myrmecia of Australia*

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The ants of the subfamily Myrmeciinae have recently been revised by Mr. John Clark of Melbourne. In many respects, I find myself in disagreement with Mr. Clark's conclusions, and a recent study tour of Australia under the auspices of a Parker Travelling Fellowship from Harvard University, and later of a United States Educational Foundation (Fulbright) Fellowship in Australia has furnished evidence leading to the revisionary notes offered below. On returning to the United States from Australia, advantage was taken of a stay of a few days in London to restudy the *Myrmecia* types of species described by Fabricius and Frederick Smith. Most of Smith's types have already been redescribed by Crawley (1926), but nowhere in Clark's work do I find any mention of Crawley's important contribution. Data supporting certain conclusions I have reached may be found in Crawley's paper, although his paper does not in any way attempt a real taxonomic revision, but merely corrects and amplifies Smith's originally very faulty descriptions and supplies new figures.

I have returned to the original conception of *Myrmecia* as a single genus including the various "jumpers" and "bull-ants" of Australia and New Caledonia; my reasons for rejecting Clark's separation of *Promyrmecia* are fully stated elsewhere (Brown, 1953). Furthermore, I consider Clark's subfamily Nothomyrmeciinae as a tribe of subfamily Myrmeciinae; *Nothomyrmecia* Clark may be regarded as the type genus of tribe NOTHOMYRMECINI (= Nothomyrmecii Clark, 1934). Subfamily rank for the Myrmeciinae is accepted, and will be discussed elsewhere.

Myrmecia Fabricius is a difficult genus taxonomically in the sense that many of its species are very variable in size, color and sculpture, while at the same time the specific differences are often based on characters that appear relatively trivial until their constancy is appreciated through the examination of large series from all parts of their ranges. This being the case, many of the species described by Mr. Clark must be considered as very doubtfully distinct. Since types of a majority of these forms were not available to me during my stay in Australia and have not become so since, no definite statements regarding many of Clark's species may be made at this time. A warning should be issued, however, that in many observed cases, Clark's descriptions and figures will not fit his type specimens that I have managed to see, and will not agree with the normally-collected individuals of species of older authors; since this author largely ignored

variation beyond single nest series or single specimens, the inevitably confusing results of such procedure will have to be dealt with by some later resident Australian worker. The doubt surrounding Clark's species partly explains the difficulties in his keys to *Myrmecia* species, and at the same time makes revision of these keys impossible. In the revisionary matter to follow, I shall deal chiefly with some of the more obvious species, concerning which the mere statement of trailing synonymy will help to right the confusion; for fuller descriptive and synonymic data, the interested reader is referred with some reservations to Clark's monograph of the Myrmeciinae (1952). Most of the species I shall treat below are discussed, figured and characterized more fully, though with many inaccuracies, in Clark's volume, where they may be traced through the index beginning on page 228; I shall include in my own synonymies only the most essential of these references.

MYRMECIA MANDIBULARIS Fred. Smith

Myrmecia mandibularis Fred. Smith, 1858, Cat. Hym. Brit. Mus. 6: 145, worker. Crawley, 1926, p. 385, fig. 10.

Myrmecia (Promyrmecia) fulvipes coelatinoda Wheeler, 1933, Colony-founding among ants, Harvard, p. 72, worker. NEW SYNONYMY.

Promyrmecia laevinodis Clark, 1943, Mem. Nat. Mus., Melbourne, 13: 139, pl. 17, figs. 94-95, worker, female. NEW SYNONYMY.

The type of Wheeler's subspecies *coelatinoda* cannot now be found, but his description strongly suggests that it was merely an old, faded or originally teneral specimen of *mandibularis* that had suffered loss of much of its pubescence through age and handling.

M. laevinodis is supposed to differ from *mandibularis* in having an essentially non-rugose postpetiolar disc, but extensive series in the Museum of Comparative Zoology show complete intergradation in this respect. In series of this form from Margaret River and Pemberton, Western Australia, the discs vary from sharply longitudinally rugose to smoothly and very finely reticulate, without suggestion of rugation or large punctures; some of these series appear from the mounting to be unindal, and are certainly sympatric. While certain populations I have observed personally appear to be purely smooth-postpetiolate (western Kangaroo Island), others from the Grampians Ranges were highly variable and contained a large proportion of undoubted intergrades. The gastric pubescence varies from red-orange to bright yellow-

golden in series from South Australia and Victoria. Clark's types of *laevinodis* appear to be classifiable as intergrades toward the smooth-postpetiolate end of the range of variation, since he mentions large indistinct punctures that are not present in the extreme smooth forms.

On Kangaroo Island, this species was found nesting unobtrusively on the high sandplain heath, whereas on the South Australian mainland the nest sites were often in dry upland sclerophyll woodlands. It runs rapidly upon being disturbed, and is adept at hiding and dodging, but no amount of stimulation of the nest or its inhabitants (in hot, direct sunlight) induced the latter to jump, at least in the localities at which I have observed it. This is contrary to older observations, although such as are found in the literature are rather vague and uncertain. *M. mandibularis*, like most of its smaller relatives, is a diurnal forager, and the golden gastric pubescence is considered to function as warning coloration.

Localities for material examined: WESTERN AUSTRALIA: Pemberton; Margaret River; Bridgetown (W. M. Wheeler, P. J. Darlington *et al.*). Swan River; Albany (J. Clark). Manjimup (W. S. Brooks). Kokerin (A. Douglas).

SOUTH AUSTRALIA: Cape Borda; south of Ravine des Casoars (W. L. Brown) (on Kangaroo Island). Mt. Remarkable, southern Flinders Ranges (W. L. Brown). Mt. Lofty; Ardrossan (J. G. O. Tepper). Mylor (G. F. Gross).

VICTORIA: Victoria Valley and Mt. Abrupt, Grampians Ranges (B. B. Given). Ballarat (H. W. Davey).

MYRMECIA RUGOSA Wheeler New status

Myrmecia michaelseni subsp. *rugosa* Wheeler, 1933, Colony-founding among ants, Harvard, pp. 60, 67, worker, "Clark (MS)."

Myrmecia mandibularis subsp. *rugosa* Wheeler, 1933, *Ibid.*, p. 72, *lapsus*.

Promyrmecia ruginodis Clark, 1943, Mem. Nat. Mus., Melbourne, **13**: 113, pl. 13, figs. 20-22, all castes, NEW SYNONYMY. (*Nec Myrmecia ruginoda* (Fred. Smith), as *Ponera ruginoda*; see below).

Clark (1952) disowns the name *rugosa* as a *nomen nudum*, but it is clear that Wheeler furnished sufficient descriptive material with the original proposal of the name. The name *rugosa* is written on a label in Clark's hand-printing affixed to specimens he had sent to Wheeler at some early date.

M. rugosa, unrelated but with a striking superficial similarity to the

rugose-postpetiolate form of *M. mandibularis*, may copy that species in grading into a related smooth-discal form (*M. michaelsoni*) apparently occurring over much the same range geographically. The present series, however, while showing some slight sculptural variation, do not suggest that the intergradation completely bridges the difference, and we must ask that more material be studied before judgement on this question can be made final. To date, I have seen only a few specimens referable to *M. rugosa*: WESTERN AUSTRALIA: Ludlow (two cotype workers in the Museum of Comparative Zoology, by present fixation) (J. Clark). Perth (Clark). Calgardup; Yallingup (Coll. Western Australian Museum).

MYRMECIA PILOSULA Fred. Smith

Ponera ruginoda Fred. Smith, 1858, Cat. Hym. Brit. Mus. **6**: 93, male. NEW SYNONYMY.

Myrmecia pilosula Fred. Smith, 1858, *Ibid.*, p. 146, worker, female, male. Crawley, 1926, pp. 383-385, fig. 9.

Ectatomma ruginodum Roger, 1861, Berl. Ent. Zeitschr. **5**: 168.

Rhytidoponera (s. str.) *ruginoda* Emery, 1911, Gen. Ins. **118**: 38.

Ponera ruginoda Clark, 1936, Mem. Nat. Mus., Melbourne, **8**: 14 (excluded from *Rhytidoponera*).

The type of *Ponera ruginoda*, a perennial puzzler, was examined in the British Museum. It proved to be a male of the common "black jumper" of southeastern and southwestern Australia; direct comparison with the male among the *M. pilosula* types certifies this identification.

M. pilosula, like other "jumpers," is normally a diurnal forager. It is an especially common ant in the southeastern part of Australia and Tasmania, where populations may become very dense in the higher mountains. Among a great many locality records for series examined, I may note as of more than usual interest the dense populations inhabiting the ravines at the western end of Kangaroo Island, South Australia, and a more dilute population sampled on the sandhills along the coast at Esperance, Western Australia (Brown). Like many another ant species in southern Australia, the range appears to be that of a relict clinging to widely separated favorable (relatively moist) areas with broad stretches of arid land intervening.

MYRMECIA FORCEPS Roger

Myrmecia forceps Roger, 1860, Berl. Ent. Zeitschr. 5: 34, worker.

Myrmecia singularis Clark, 1952, Formic. Australia, Melbourne, 1: 26-27, fig. 5, worker. NEW SYNONYMY.

The type of *M. singularis* is a worker with the structure of *M. forceps* and "colour almost entirely that of *M. rufinodis* Smith." Specimens taken by myself at Kingscote, Kangaroo Island, South Australia fit this description quite satisfactorily, and Kingscote is very probably the exact type locality for Clark's species. At Kingscote, *M. rufinodis* is the dominant *Myrmecia* along the coast, and its nests are very numerous and conspicuous there. I took the few *singularis* specimens in the midst of this area from a nest notable only for its inconspicuousness; the entrance consisted of a single hole without a mound or crater and was rather well concealed in the leaf litter. Considerable digging revealed only a very few ants, which contrasted in their timidity with the aggressive defenders of the populous neighboring *rufinodis* nests. I feel that the situation at this locality can be explained as a case of Müllerian mimicry. It should be noted that the Kingscote series copied most closely the coloration of the *rufinodis* workers of corresponding size, even to following exactly the same variations in pattern.

As interesting as this situation seems, I cannot support *singularis* as a species distinct from *forceps*. The series in the Museum of Comparative Zoology, while limited, show every degree of intergradation to the "typical" condition of *forceps* if one collects all specimens with *forceps*-type mandibles from all localities into one group for comparison. The "typical" coloration is ferruginous red, with gaster blackish, and mandibles and appendages much lighter and more yellowish; I have a series from Heathcote, New South Wales, answering to this color form (W. M. Wheeler *leg.*). A form with darker head, mentioned by Clark (1952, p. 24), is represented in my present series by examples taken at Sutherland, New South Wales (C. P. Haskins) and by myself on the high mallee heath of inland Kangaroo Island just east of Sandy River. In the latter locality, the nest was a low, flat mound about 2 feet in diameter, with a single entrance hole in the center surrounded by a radiating circle of short sections of twigs arranged with considerable symmetry on the surface of the mound. In both these and the Sutherland specimens, the alitrunk is unclouded ferruginous, while the head is largely or wholly brownish-black. Series from SOUTH AUSTRALIA: Port Lincoln (F. E. Wilson), Goolwa (Zeitzi)

and the Mt. Lofty Ranges (J. G. O. Tepper) vary so as to completely close the gap in color pattern between *forceps* and *singularis*, though variation in single nest series does not seem ever to express the full variability of the species. It is worthy of note that Port Lincoln and the Lofty Ranges also have large local *rufinodis* populations, and that *rufinodis-singularis* mixed collections with similar coloration, at least in part, were apparently separated by someone after the series had reached the Museum.

It appears to me probable that *forceps* is a species with highly variable color patterning lending itself to production, by natural selection, of local color forms which mimic effectively the dominant *Myrmecia* species of the respective areas.

MYRMECIA RUFINODIS Fred. Smith

Myrmecia rufinodis Fred. Smith, 1858, Cat. Hym. Brit. Mus. 6: 145, worker, original description. Clark, 1952, *op. cit.*, pp. 37-40, figs. 15, 16, worker, female, male, with *M. gracilis* as distinct species.

Myrmecia gracilis Emery, 1898, Rend. Accad. Sci. Bologna 3: 232, worker, NEW SYNONYMY.

Myrmecia (s. str.) *crudelis* var. *gracilis* Emery, 1911, Gen. Ins. 118: 19.

As discussed above under *M. forceps*, I found this species to be abundant at Kingscote, the type locality for *M. gracilis*. In each nest, the individuals varied considerably in color, the extremes following the color details given by Clark for *rufinodis* and *gracilis*, while intermediates were even more common. It is difficult to believe that Clark's extensive series did not contain some of these intermediates, since I have found them consistently in the majority, not only in the Kingscote series, but also in those from Port Lincoln and other littoral localities widely separated in lower South Australia. At any rate, at least some specimens from each of the nests from Kingscote compare very well with the type and other specimens of *rufinodis* in the British Museum. Emery's *gracilis* is only a common variant found in every nest seen, and always accompanying the "typical" *rufinodis*. This species was found foraging in abundance late on a warm but windy and rainy morning at Kingscote. The nests are populous and are surmounted by a conspicuous mound up to 3 feet in diameter and about one foot high; the surface of the mound is frequently "decorated" with bits of gravel or short sections of twigs or straws. The inmates are very alert and aggressive — more so than most *Myrmecia* species —

in defending their nest. The coloration is considered to be of a warning type, as it renders the insects conspicuous in their natural surroundings. They appear to be chiefly diurnal foragers.

Among species from the same area, *rufinodis* is likely to be confused only with (1) *M. simillima* Fred. Smith, which is larger and more robust and does not include a form with reddish pronotum on blackish alitrunk such as is common in all *rufinodis* nests, and (2) *M. pulchra* Clark, a species of more robust stature and with quite different mandibles.

MYRMECIA PYRIFORMIS Fred. Smith

Myrmecia pyriformis Fred. Smith, 1858, Cat. Hym. Brit. Mus. 6: 144, pl. 10, figs. 1-6, worker, female, male. Crawley, 1926, p. 377, fig. 4.

Myrmecia sanguinea Fred. Smith, 1858, Cat. Hym. Brit. Mus. 6: 148, worker. Crawley, 1926, p. 378, fig. 5. NEW SYNONYMY.

Myrmecia simillima Clark (*nec* Fred. Smith), 1952, Formic. Australia, Melbourne, 1: 89-91, figs. 68, 69, worker, female.

Myrmecia pyriformis Clark, 1952, *Ibid.*, pp. 99-101, figs. 78-80, worker, female, male.

Myrmecia forficata Clark, *partim* (*nec* Fabricius), 1952, *Idem*, p. 93.

M. pyriformis is a very common species in open sclerophyll woodland in southeastern Australia. It often builds conspicuous mounds, and is normally a night forager. In order to prevent any further confusion regarding this species, it is necessary to refer to some of the outstanding characters.

The stature is large, averaging larger than in *M. forficata*, the color is darker, with the head and alitrunk dark reddish-brown to blackish-brown, and the sculpture of head, alitrunk and nodes is more irregular and more opaque. The mandibles are essentially like those of *forficata*, but the angulate portion near the base (inner borders) is even broader and more strongly salient. The clypeus is densely pubescent, the whitish hairs usually hiding the surface here. Postpetiole and succeeding (basal gastric) tergite in unworn specimens normally bearing a very short but fairly dense reclinate pubescence of a light grayish or brownish color. The pronotal costulation (or striation) varies considerably in pattern, even in uninidal series; some specimens have longitudinal costulation in the middle, others have the lines converging anteriorly in a V, and still others are narrowly- to broadly-arched costulate in a more or less transverse direction.

The maladroit treatment accorded this species by Clark may be laid to his lack of consideration of Crawley's paper redescribing Smith's types, and also to his failure to study pronotal sculpture through sufficient series. My study of the types of *pyriformis* and *sanguinea* in the British Museum confirms the synonymy of these forms, also indicated (but not proposed) in Crawley's characterizations. The types and Crawley's paper also clearly contraindicate Clark's identification of *simillima*, the latter being a quite distinct species treated at length farther below. The two species *forcicata* and *pyriformis* occur together throughout a wide area without a sign of intergradation, though small specimens, such as the *sanguinea* type, may resemble the *forcicata* medias and minors in everything but pubescence.

MYRMECIA AURIVENTRIS Mayr

Myrmecia auriventris Mayr, 1870, Verh. Zool.-bot. Ges. Wien **20**: 968, worker.

Clark, 1952, *op. cit.*, pp. 40-42, figs. 17, 18, worker, male.

Myrmecia auriventris var. *athertonensis* Forel, 1915, Ark. f. Zool. **9**: 8, worker, male. NEW SYNONYMY.

The type of the variety *athertonensis* is not available, but Forel's description applies to certain slight color variants that can be found in many nest series along with the "typical" form. *M. auriventris* ranges widely in the open forest country along the tropical coast of Queensland from the Maryborough region northward. The range is greatly extended by the following new records from Central Cape York: Lankelly Creek in the Mellwraith Range and the Rocky Scrub, near Coen (P. J. Darlington). I observed this species on the main Kuranda road east of Mareeba, northern Queensland, while I was in the company of Dr. J. G. Brooks of Cairns. At this locality, *M. auriventris* can be found foraging on eucalypt saplings in broad daylight. The coloration and bright golden gastric pubescence are of the warning type, in good correspondence with the diurnal foraging habits.

MYRMECIA ROWLANDI Forel

Myrmecia tarsata subsp. *rowlandi* Forel, 1910, Rev. Suisse Zool. **18**: 4, worker.

Myrmecia tarsata r. *malandensis* Forel, 1915, Ark. f. Zool. **9** (16): 9, worker, male. NEW SYNONYMY.

Myrmecia rowlandi Clark, 1952, Formic. Australia, Melbourne, **1**: 78-79, fig. 56, worker; see also *M. tarsata malandensis*, p. 32.

The characters cited by Forel for the separation of *M. rowlandi* and *M. tarsata malandensis* are either inconsequential, such as the depth of coloration and pubescence of the gastric apex, or are the distinctions to be expected between normally allometric *Myrmecia* workers of different sizes. It is perhaps significant that Clark assigned all material from the Cairns-Atherton Tableland area to *M. rowlandi*, and did not mention having seen specimens referable to *malandensis*. Specimens in the Museum of Comparative Zoology determined as *malandensis* by Wheeler either fit the characterization of *rowlandi* or are close to and intergradient with these.

I agree with Clark in separating this form from *M. tarsata* Fred. Smith. A live worker was seen at Kuranda in northern Queensland in deep rainforest, being borne along in an enfeebled condition by several workers of *Occophylla virescens* Fabricius, the common green tree ant of coastal tropical Australia. The *Occophylla* has apparently increased in the Kuranda area in recent years, according to local inhabitants, and this increase may well account for the present rarity of *Myrmecia* species in rain- and gallery-forest patches near the village.

MYRMECIA MJÖBERGI Forel

This very distinct, slender, long-headed species apparently also suffers from the invasion of *Occophylla*, since it is found in its usual rainforest haunts only when these are free of the tree-ants. I found *M. mjöbergi* 12 to 20 miles north of Kuranda, along the Black Mountain timber track on the west side of the MacAlister Range in exceptionally fine rainforest. It nests high in the tops of trees in the "peat" gathered by epiphyte masses, including various ferns, orchids and the like; it is not restricted to any one plant group for this purpose. The colonies appear to be populous, and are greatly respected by the timbercutters, who find them in most suitable epiphytic masses in the trees they cut down. As one might predict from the dull reddish-brown coloration of head and alitrunk, this species is a nocturnal-crepuscular forager (at least as observed at intact nests in recently-felled trees), but it will defend its nest quite aggressively if the mass is strongly disturbed in bright sunlight, occasionally taking short jumps toward the source of disturbance. For this reason, many of the bushmen know the ants as "jumpers", though the habit is certainly not very conspicuous or striking in this species. New northern records are from central Cape York: Lankelly Creek and the Rocky Scrub, Coen District (P. J. Darlington).

MYRMECIA SIMILLIMA Fred. Smith

- Myrmecia simillima* Fred. Smith, 1858, Cat. Hym. Brit. Mus. **6**: 144, *nec* Clark, 1952, p. 89. Crawley, 1926, p. 376, fig. 3.
- Myrmecia crudelis* Fred. Smith, 1858, Cat. Hym. Brit. Mus. **6**: 147. Crawley, 1926, p. 374, fig. 1. Clark, 1952, pp. 35-36, fig. 13, worker. NEW SYNONYMY.
- Myrmecia tricolor* Mayr, 1862, Verh. zool.-bot. Ges. Wien **12**: 724, worker. NEW SYNONYMY.
- Myrmecia nigriventris* Mayr, 1862, *Ibid.*, pp. 724, 727, worker. NEW SYNONYMY.
- Myrmecia spadicea* Mayr, 1862, *Idem*, pp. 724, 728, worker (*recte* ergatoid female).
- Myrmecia paucidens* Forel, 1910, Rev. Suisse Zool. **18**: 5, worker. NEW SYNONYMY.
- Myrmecia tricolor* var. *rogeri* Emery, 1914, Boll. Lab. Zool. Portici **8**: 181, worker. NEW SYNONYMY.

This species has mandibles with dentition similar to that of *M. forceps*, with four or five larger teeth and more or less reduced or vestigial teeth between these, but the external borders are approximately straight for most of their length. Looked at closely, this straightness of the external borders varies from very slightly convex to very slightly concave within unidual series, and a further gross illusion of convexity or concavity is produced by various positions (degrees of closure) in which the dried specimens have the mandibles fixed. Forel's *paucidens*, types of which I have not seen, follows specimens of the red or "*nigriventris*" phase if one considers that Forel probably made his description with the use of a simple hand lens, as he frequently did with large specimens.

The numerous synonyms may be blamed partly on the wide range of color variation shown by the species, and to a lesser extent on the variation in the direction of the pronotal striation. Three color variants may be recognized on a strictly arbitrary basis; the present abundant material available (series from at least 32 nests from 29 localities, mostly numerous in individuals, and including the types of *M. crudelis* and *M. simillima* in the British Museum) shows that these phases are completely intergradient both inter- and intranidally. The intergradation has been recognized, in a rare discussion of color variation, by Clark (1952, p. 45), and also by Wheeler (1933, p. 44). The phases are, roughly: "black," with head, alitrunk and nodes black or brownish-black (*M. rogeri*, types of *M. simillima* and *M. crudelis*);

"tricolored," as in the black phase, but with propodeal apex and both nodes more or less reddish (*M. tricolor*); "red," with head, alitrunk and nodes varying shades of deep red, the nodes and propodeal apex often lighter than the remainder, and gaster blackish (*M. nigriventris*, *M. paucidens*). The full range of variation seems only rarely to occur within one nest series, or possibly never, if some of my series really represent collections from two or more nests at the same locality, but it is certain that intranidal variation is great and that the internidal overlaps are broad and without discontinuities throughout the range of differences, considering all safely uninidal series.

In general, the darker phases tend to occur in mountainous areas, and the redder phases in lowland areas with slightly drier, more open forest, but the intergradation in the Blue Mountains of New South Wales and other areas is so broad that apportionment of geographical races seems impossible, at least without further evaluation of the situation through close field work. I personally feel that the variation, like that of *Camponotus cousobrinus* (Erichson) and other ants with a similar range and color variation featuring progressive melanization, may be due to ecological (non-genetic) influences, such as temperature, humidity and insolation, rather than to genotypic differences of such magnitude and geographical consistency as to be worth racial recognition.

Material examined, exclusive of the types of *M. simillima* and *M. crudelis* in the British Museum, is now largely in the Museum of Comparative Zoology. With the localities for these series, I have indicated the phases to which individuals from each of the localities may be arbitrarily assigned according to a choice based on the discussion above. A worker specimen now deposited in the Museum of Comparative Zoology: Mt. William, Grampians Range, Victoria, 8-12-51 (F. E. Wilson), has been closely compared with the *crudelis* type ("type" in B.M. chosen as lectotype) and is so similar as to be safely considered a reliable digm. The *simillima* type is also closely similar to this specimen, but has the external mandibular borders extremely slightly concave. The specimen indicated as the "type" in the British Museum under *M. simillima* should be considered as lectotype of that species.

Other material studied from: NEW SOUTH WALES: Uralla; Gosford; Parramatta; Salisbury Court (black); Hornsby (black, tricolor); Wentworth Falls; Mt. Wilson; Sutherland; Leura; Katoomba (tricolor, red) (W. M. Wheeler). Pymble (black) (J. McAreavey).

Megalong Valley (black, tricolor, red) (P. J. Darlington). Blue Mountains (tricolor) (H. J. Carter). Jenolan Caves (tricolor, red) (J. C. Wiburd). Leura; Katoomba (tricolor, red); Otford; La Prouse; Heathcote; Manly (red) (W. M. Mann). The Creel, Mt. Kosciusko, 3000 feet (red) (W. M. Wheeler).

VICTORIA: Arthur's Seat near McCrae, 900 feet; Dandenong Creek at Vermont; Burwood (red) (W. L. Brown). Eltham (red) (F. E. Wilson). Dee Creek, Warburton Range (red) (W. M. Wheeler). The specimens from western Victoria and southern South Australia include all color phases, black being predominant in the Grampians Range, at least in the higher parts, according to series examined in several Australian collections and in the British Museum, and to the records given by Emery and Clark (see Clark, 1952, pp. 36, 45).

My observations on this species, made on the red phase in the vicinity of Melbourne, indicate that it is predominantly a crepuscular-nocturnal forager but that it may forage in the early morning or late afternoon during cool weather. The close resemblance of the red phase to *M. forficata* may indicate that mimicry is operating; *M. simillima* is the less common where the two occur together. The nest is made in the earth, with or without a small mound. Near Melbourne, the nests are not very populous; I once found a half-dozen ergatoid females and two large workers with a small amount of brood in a two-chambered cavity reached by a hole beneath a rusted bit of tin lying on the ground (September, 1952, at Burwood, Victoria). The ergatoid females from this group foraged freely for several days before I finally traced one of them back to the entrance. I cannot satisfactorily explain this aggregation; it may have represented part of a disrupted nest remaining from the previous year. In various parts of New South Wales where *M. tarsata* is abundant, the black phase of *simillima* closely resembles it. *M. tarsata* is distinct, however, in possessing a bluish metallescence over the jet-black body and in having the gastric apex yellowish. The species described by Clark as *M. simillima* is actually *M. pyriformis*, following an old confusion of the two that could have been avoided through attention to Crawley's paper (*op. cit.*).

MYRMECIA VARIANS MAYR

Myrmecia varians Mayr, 1876, Jour. Mus. Godeffroy **12**: 94, worker.

Promyrmecia wilsoni Clark, 1943, Mem. Nat. Mus., Melbourne, **13**: 127, pl. 15, fig. 69, worker. NEW SYNONYMY.

PromyrmeCIA shepherdI Clark, 1943, *Ibid.*, p. 128, pl. 15, figs. 50-52, all castes. NEW SYNONYMY.

PromyrmeCIA goudieI Clark, 1943, *Idem*, p. 129, pl. 15, figs. 48-49, worker, female. NEW SYNONYMY.

PromyrmeCIA marmorata Clark, 1952, *Formic. Australia* 1: 188, fig. 157, worker. NEW SYNONYMY.

M. varians and the four junior synonyms listed above constitute what Clark (1952, pp. 120-122, 181-189) called the "variens group" of *PromyrmeCIA*, characterized chiefly on the basis of the long, slender worker mandibles with externally concave borders and the larger teeth more or less recurved, or "hook-shaped," as Clark put it. Several other *MyrmeCIA* species outside this "group" have dentition which could be described as "hook-shaped," a fact that does not seem to have been properly taken into account in the 1952 or earlier works. More or less hook-shaped teeth occur widely in the group about *M. pilosula* ("pilosula group" of Clark), though not indicated in Clark's figures. A cotype of *M. elegans* (Clark) in the Museum of Comparative Zoology has mandibular teeth no less strongly recurved than those of *M. varians*.

When Mayr named this species, he did so most appropriately and wisely, and it is unfortunate that Clark has not seen fit to consider the extreme variation in the same sound and conservative way. In the series before me, including at least 11 nest-samples from three states, I find variation encompassing all of that mentioned in Clark's key and following descriptions. The key characters cut broadly in all directions across single nest series from my own collection. For instance, in single nests from Wilpena Pound, where this species is very common, I took specimens with solid black, solid red, and mottled red-and-black postpetiolar surfaces. Mandibles in my present series range from yellow to dark brown in color, and the alitrunks from entirely red to black with a hint of red on the propodeum. The carina between the frontal carinae may be distinct, or it may be so indistinct as to be virtually non-existent; the pubescence of the first gastric segment is likely to be rubbed off in old specimens or mishandled ones, a fact that could easily account for the condition described by Clark for *M. marmorata*. Comparison of types of *variens* and *shepherdI* before me reveals no significant difference in propodeal sculpture as described by Clark. I can only conclude from these series that the synonymous forms listed are slight individual variants of one species, *M. varians*, ranging widely through the dry savannah country of Queensland far

south into the desert country of South Australia and the more arid portions of New South Wales and Victoria. In the true desert country of South Australia, such as at Leigh Creek, the nests appear to be pretty well confined to creek beds supporting red gum or coolabah trees.

The nests are entered by one or two small holes without mound or crater, and are usually situated near trees or shrubs upon which the ants do much of their foraging. Outside the entrance gorge at Wilpena Pound, in mixed red gum-*Callitris* woodland, *M. varians* is the dominant day-foraging *Myrmecia*. A similar-appearing form, "scabra" of the *M. harderi* complex, also occurs at the same locality, and there is no sign of intergradation between the two.

Localities for *M. varians* material studied in the Museum of Comparative Zoology: SOUTH AUSTRALIA: Lake Callabonna (A. Zeitz). Nuriootpa, one male (J. O. Tepper). Barren Falls, at the eastern edge of the Lofty Ranges near Mannum, in arid inlier; Leigh Creek, in shade of red gums in dry creek bed, foraging in thin leaf litter; Wilpena Pound (W. L. Brown). NEW SOUTH WALES: Broken Hill, type of *Promyrmecia shepherdii* Clark (F. W. Shepherd). QUEENSLAND: without further locality, type of *M. varians* from Coll. Mus. Godeffroy. Brisbane (H. Hacker).

MYRMECIA HARDERI Forel

Myrmecia harderi Forel, 1910, Rev. Suisse Zool. **18**: 8, worker.

Promyrmecia harderi Clark, 1952, Formic. Australia, Melbourne, **1**: 215-217, figs. 181, 182, worker, female.

? *Promyrmecia scabra* Clark, 1943, Mem. Nat. Mus., Melbourne, **13**: 118, pl. 14, figs. 40, 41, worker, female. NEW SYNONYMY WITH DOUBT.

? *Promyrmecia maloni* Clark, 1943, *Ibid.*, p. 121, pl. 14, fig. 43, worker. NEW SYNONYMY WITH DOUBT.

M. harderi and its close relatives listed above have longitudinally rugose postpetioles. Clark describes *M. harderi* itself as having a "yellowish red" alitrunk and the center of the petiole of the same color. A specimen before me from the type series, *ex* Gunnedah, New South Wales, has the center of the postpetiole black, with a lateral red patch on each side, and the center of the mesonotum bears a small but distinct blackish spot. Otherwise, I have a number of specimens taken from three nest series at Wilpena Pound, Flinders Ranges, South Australia, by myself, and these vary considerably in color. Some

specimens have only the mesonotum blackened, while in others a broad black strip extends forward the length of the pronotum. The mandibles and antennae also vary somewhat in the depth of light brownish infuscation over their yellowish base color. Considering the total variation in color and, to a much lesser degree, in postpetiolar sculpture in the present material, I believe that the chief differences recognized by Clark between his species *scabra* and *maloni*, and between these two and *harderi*, can no longer be considered significant. No other differences cited by Clark appear to be particularly important, and in the absence of types of his species, I must consider the synonymy of all of these species highly probable. Types of Clark's species are in the National Museum at Melbourne, and Mr. E. F. Riek, who has kindly examined them at my request, states *in litt.* that he can find no differences between them save those discussed above, except possibly a very minor divergence in mandibular dentition. The variation in this species is so marked that it is not beyond possibility that *M. celaena* (Clark) is only an extreme melanic variant synonymous with *M. harderi*; the two have been found once at the same station, according to Clark: Narrabri, New South Wales.

At Wilpena Pound, the *scabra-maloni* color form of *M. harderi* nested in the dry leaf litter beneath the "native pines" (*Callitris*) in fine, reddish sandy loam, at this point covered with open *Callitris-Eucalyptus camaldulensis* woodland. The entrance to the nest was a slender, tapered turret fashioned from fine vegetable detritus and projecting upwards through the thin leaf litter to a height of about 2 centimeters, with the circular opening at the apex. No auxiliary entrance was seen in either of two nests dug up. *M. varians* was also common at this locality, but tended to nest more in the open; both species run very rapidly and jump when disturbed.

MYRMECIA FROGGATTI Forel

Myrmecia froggatti Forel, 1910, Rev. Suisse Zool. **18**: 9, worker.

Promyrmecia froggatti Clark, 1952, Formic. Australia, Melbourne, **1**: 128-129, figs. 96, 97, worker, female; see for further synonymy.

Myrmecia (*Promyrmecia*) *aberrans* subsp. *taylori* Wheeler, 1933, Colony-founding among Ants, Harvard, p. 53, worker. NEW SYNONYMY.

Myrmecia (*Promyrmecia*) *aberrans* subsp. *sericata* Wheeler, 1933, *Ibid.*, p. 53, worker. NEW SYNONYMY.

In the Museum of Comparative Zoology are a specimen from the

type series of *M. froggatti*, ex Manilla, New South Wales (W. W. Froggatt) and the unique types of subsp. *taylori*, ex Roma District, Queensland (F. H. Taylor) and subsp. *sericata*, ex Wagga Wagga, New South Wales (W. W. Froggatt). The *M. froggatti* specimen has been badly rubbed, thereby lacking most of the gastric pubescence and appearing somewhat more shining than the two sub-species. Otherwise, the differences are rather trivial — scarcely more than what one would expect in the way of variation among members of single nest series in this complex. While even this slight variation might, allopatry considered, be indicative of valid geographical races, I feel that in this case the burden of proof must be shifted to anyone who wants to consider them as such. Certainly, the differences do not look half so impressive when the actual specimens are compared as they do in Wheeler's descriptions. Clark's species *Promyrmechia eupocila*, *P. greavesi* and *P. excavata* appear to me, from Clark's characterizations, to be scarcely distinguishable from *M. froggatti*. Quite possibly they are synonyms.

MYRMECIA MAURA MAURA Wheeler New status

Myrmecia (*Promyrmechia*) *aberrans* subsp. *maura* Wheeler, 1933, Colony-founding among Ants, Harvard, p. 51.

Promyrmechia maura Clark, 1952, Formic. Australia, Melbourne, 1: 132-134, figs. 100, 101, worker, female; see for further synonymy.

M. maura has always been considered rather distinct because it is the only known all-black member of its group. Close inspection of the type series in the Museum of Comparative Zoology, however, reveals that some of these specimens show a feeble hint of reddish discoloration on the sides of the head and on the pronotum. Since the types are from Bathurst, New South Wales, and since other *m. maura* records are cited by Clark from Western Slope and Southern Tableland localities in New South Wales, but not from the Northern Tablelands, it appears at present as though *m. maura* and the forms with much bright red on head and alitrunk may be allopatrically and sub-specifically separated. The graded series of reddened forms described by Wheeler under the names *formosa* and *haematosticta* come from Uralla on the Northern Tableland. Possibly the main range of the red-and-black form extends into Queensland, with Uralla at one edge of the intergrade zone. If further collection bears this out, the name of the red-and-black form should be *M. maura formosa*, and the name

haematosticta will sink as applying to the intergrades. On the other hand, it is entirely possible that the red-and-black forms are merely non-geographical variants appearing at intervals through the *maura* range, in which case the names *formosa* and *haematosticta* will both sink as synonyms. I prefer for the moment to consider the situation as a probable case of polytypy in the species *maura*.

Clark's specific separation, based on types of the three forms sent him in 1947, fails to take into account the great variation in color of the Uralla series. Since this variation bridges the *maura-formosa* differences almost perfectly, I cannot accept Clark's artificial three-way split. The synonymy of *M. maura formosa* follows.

MYRMECIA MAURA FORMOSA Wheeler New status

Myrmecia (Promyrmecia) aberrans subsp. *formosa* Wheeler, 1933, Colony-founding among Ants, Harvard, p. 52, fig. 19, worker.

Myrmecia (Promyrmecia) aberrans subsp. *haematosticta* Wheeler, 1933, *Ibid.*, p. 51, worker. Intergrade, *maura maura* × *maura formosa*, NEW SYNONYMY.

Promyrmecia haematosticta Clark, 1952, Formic. Australia, Melbourne, 1: 130, fig. 98, worker.

Promyrmecia formosa Clark, 1952, *Ibid.*, p. 131, fig. 99, worker.

Wheeler's series from Uralla in the Museum of Comparative Zoology consist of a half-dozen *formosa* cotypes and (at present) a single cotype of *haematosticta*; all of these specimens are dated November 26. The *formosa* series includes variations leading up to *haematosticta*, which latter is only slightly more extreme than the darkest *formosa* worker.

MYRMECIA NOBILIS (Clark) New combination

Promyrmecia nobilis Clark, 1943, Mem. Nat. Mus., Melbourne, 13: 97, pl. 12, figs. 2-4, all castes; see Clark, 1952, p. 124 for further synonymy.

While the present material seems to indicate that *M. froggatti*, *M. maura* and *M. nobilis* represent very closely related, but probably distinct species, I am by no means so sure of the distinctness of *M. nobilis* from *M. aberrans*. Without type material of *aberrans*, it is perhaps wise to accept tentatively Clark's judgement on these forms. I took *M. nobilis* at Lara, Victoria, on the savannah west of Melbourne, in a nest surmounted by a slender earthen spout about one cm. high.

MYRMECIA PILIVENTRIS Fred. Smith

Myrmecia piliventris Fred. Smith, 1858, Cat. Hym. Brit. Mus. **6**: 146, worker.
Crawley, 1926, p. 385, fig. 11, worker.

Promyrmecia piliventris Clark, 1952, Formic. Australia, Melbourne, **1**: 156-158, all castes; see for further synonymy, figures.

Myrmecia piliventris var. *rectidens* Forel, 1910, Rev. Suisse Zool. **18**: 5, worker.
NEW SYNONYMY.

Promyrmecia rectidens Clark, 1952, Formic. Australia, Melbourne, **1**: 159-161, figs. 126-128, worker, subapterous and ergatoid females; see for further synonymy.

M. piliventris shows great differences in size between different nest series, so that two nests located within 25 meters of one another may appear like two totally different species. Large series, however, if representing numerous nests, show all intermediate size stages. Sometimes one notices slight differences, apparently following allometric patterns, between size extremes, and it appears that Forel named the var. *rectidens* on the basis of smaller specimens. In attempting to strengthen the distinction between the two "species," Clark has on different occasions utilized different characters, such as presence or absence of postpetiolar pilosity and supposed constant mandibular differences. From the series present in the Museum of Comparative Zoology, I am satisfied that such distinctions will not hold with sufficient constancy, particularly when the probable intertidal allometry is fully considered. Clark found the smaller variety to produce subapterous or ergatoid females, a phenomenon possibly correlated with the stature of the workers and one that might indicate a strong effect of environmental influences on body size and form in this species. A similar effect is also seen in the related *M. fulvipes* and to a lesser degree in other *Myrmecia* species.

This species is much more common in South Australia than published records indicate, and is especially abundant in the Flinders Chase area of western Kangaroo Island, where it nests under stones and logs or grass-tree stumps in the luxuriant sugar gum ravines as well as in the much drier *Casuarina* and malleescrubs and occasionally on the heathland. Individuals from colonies taken on the heath are noticeably smaller than are those from the Ravine des Casoars. A colony taken along Weetangeera Road in the Black Mountain Forest near Canberra (*Eucalyptus macrorrhyncha*-*E. melliodora* woodland) contained the largest workers seen (T. Greaves and W. L. Brown).

MYRMECIA FULVIPES Roger

Myrmecia fulvipes Roger, 1861, Berl. ent. Zeitschr. 5: 36, worker.

Promyrmecia fulvipes Clark, 1952, Formic. Australia, Melbourne, 1: 165-167, figs. 133-135, all castes; see for further synonymy.

Myrmecia (Pristomyrmecia) piliventris var. *femorata* Santschi, 1928, Bull. Soc. Vaud. Sci. Nat. 56: 466, worker. NEW SYNONYMY.

Myrmecia (Promyrmecia) fulvipes subsp. *barbata* Wheeler, 1933, Colony-founding among Ants, Harvard, p. 71. NEW SYNONYMY.

(Cf. Clark assignments and additional synonymy for these forms in his 1952 revision, pp. 158-159, 162-167.)

This species may be recognized by means of its greenish-golden gastric pubescence and the contrasting color of the legs against the black of the body; the femora and usually most of the rest of the legs are yellowish-red, with varying areas of infuscation. Clark's reasons for assigning var. *femorata* and subsp. *barbata* to *piliventris* instead of to *fulvipes* are enigmatic, especially since Wheeler had correctly stated their close relationship to *fulvipes* in 1933. I can think of no reason for Clark's action other than that he merely followed Santschi's original thoughtless assignment of *femorata* to *piliventris*. Obviously, Santschi never took *fulvipes* into account in describing his variety, or he would have realized that the latter was *fulvipes* to begin with. *M. piliventris* is, in my view, a completely distinct species, as proved by the absence of intergrades to *M. fulvipes* despite the slightly variable extent of infuscation of the tibiae in the latter. *M. fulvipes* is an eastern coastal species with a range extending into the higher mountain forests of the southeastern regions and Tasmania, west at least into the Grampians Ranges of western Victoria; it prefers a relatively moist, cool climate. *M. piliventris* prefers to nest in dry, open woodlands or even on open heath, and hence it is more common in the western and Tablelands regions of New South Wales and in northern and western Victoria and southern South Australia. The record of *M. fulvipes* cited by Clark from Murray Bridge, South Australia, is rather unusual and should be checked, although *M. fulvipes* may occur in the moister Lofty Ranges of South Australia.

Wheeler's subsp. *barbata*, the types of which have recently been found among the Wheeler miscellany, is a large, slightly more hairy form occurring with and intergrading to the average-sized form in the wet mountain forests of New South Wales; the present evidence does not indicate that nomenclatorial distinction for this local variant should be maintained. *Myrmecia fulviculis* Forel is a *fulvipes*-like

form occurring along the North Coast of New South Wales from about Sydney northward, and around Brisbane in extreme southeastern Queensland. It differs from the typical *fulvipes* in the color of the gaster, which is brown shading into yellowish toward the apex; while certain entire nest series seem to show this color pattern more or less distinctly, the typical *fulvipes* pattern is also reported from just about exactly the same range of localities by Clark (1952, as *M. piliventris femorata*, p. 159), although without information concerning presence or absence of intergrades. Later investigation will establish whether *fulviculis* is a genetically independent species, a northern race of *fulvipes*, or an environmentally-induced variant, synonymous with *fulvipes*.

MYRMECIA BREVINODA Forel

Myrmecia forficata var. *brevinoda* Forel, 1910, Rev. Suisse Zool. **18**: 2, worker, female, *nec* Clark, 1952, pp. 96-97.

Myrmecia pyriformis race *gigas* Forel, 1913, Rev. Zool. Afr. **2**: 310, female.
NEW SYNONYMY.

Myrmecia gigas Clark, 1952, pp. 104-109, fig. 83, all castes, including various sizes of workers and ergatoid female; see for further synonymy.

The Museum of Comparative Zoology possesses a cotype minor worker of var. *brevinoda* sent by Forel to Wheeler. Close comparison shows that this worker agrees very well with minors of the species assigned by Clark to *M. gigas*. The *brevinoda* type locality, Walcha, New South Wales (W. W. Froggatt), also agrees well with the range of *gigas*, and the latter name must therefore fall. The species Clark described and figured as *M. brevinoda* appears to me to be a slight and common variant of *M. forficata*.

MYRMECIA FERRUGINEA Mayr New status

M. nigriceps var. *ferruginea* Mayr, 1876, Journ. Mus. Godeffroy **12**: 95 (p. 40 of reprint), worker.

Myrmecia (*Myrmecia*) *vindex*, Emery (*partim*), 1911, Gen. Ins. **118**: 19, *nec* Fred. Smith.

Mayr described this species very briefly in passing, believing it to be a mere color variant of *nigriceps*, so we do not have a very clear idea of its true identity. Mayr mentions variation in color that could apply to two or more species, so I hereby restrict the name *ferruginea*

to that part of his type material having a light-colored "forebody." It is quite possible that this form is the senior synonym of *brevinoda* and *gigas*, coming as it does from localities in central Queensland. It might also be the same as *M. dimidiata* Clark, since the first gastric segment is said by Mayr to be reddish in tone. Variation in *M. brevinoda* includes forms with persistent or deciduous anterior gastric pubescence and a range of forms of petiolar node; *M. ferruginea* will have to be considered as a name available for one species in this group. Besides *M. dimidiata*, Clark's inadequately distinguished species *M. dccipians* and *M. hirsuta* may also be involved in this complex. The solution depends on a fuller characterization of the *M. ferruginea* types and a study of the variation in *M. brevinoda* and related forms. Curiously, Clark does not appear to have mentioned *M. ferruginea* in his revision, and it is not in the index.

MYRMECIA FLAMMICOLLIS New species

Diagnosis. A medium-sized, slender *Myrmecia* of the *apicalis* group, most closely resembling *M. petiolata* Emery, from which species it differs most conspicuously in color, the body being black, with the prothorax largely or entirely orange-red.

Holotype worker. Comparison is largely made with *M. nigrocincta* Fred. Smith, a closely related and common eastern Australian species.

General body color black; entire prothorax clear light orange-red. Mandibles, antennal scapes and legs deep reddish-brown; funiculi, extreme bases and apices of scapes, inner margins of mandibles, palpi and anterior tarsi shading into sordid yellow. Mandibular teeth infuscated.

Dimensions (in millimeters). Total length fully outstretched, not including mandibles, 13.0 ± 0.1 ; length of head, including clypeus, 2.37; width of head without eyes 2.34, with eyes 2.66; straightline exposed length of left mandible while in closed position 2.41; full length of scape 2.85; full exposed length of alitrunk in lateral view 4.64; of petiole 1.46, of postpetiole 1.17, and of gaster 3.4.

Sculpture as in *M. nigrocincta*, but slightly stronger and more opaque, especially on the cephalic dorsum. Pronotal sculpture as in *nigrocincta*, very finely reticulo-striate in front, with superimposed costulation or rugulation following the striation, largely transversely arched. Mesonotum similar, except that here the superimposed transverse costulation becomes much feebler posteriorly on the disc.

Petiole, postpetiole and gaster moderately shining, very finely and rather densely punctulate, the petiole more strongly shining than in *nigrocincta*.

Pilosity as in *nigrocincta*, except that the scapes bear sparsely distributed, very fine and short oblique erect hairs throughout, and not just at the apices. Pubescence appressed, whitish except on the center of the basal gastric tergite, where it has a feeble yellowish tinge; rather abundant and generally distributed over the body and appendages; most dense on gaster (but not hiding sculpture on basal tergite) and on clypeus.

Mandibles resembling those of *nigrocincta*, but a little broader just distad of their bases, their inner margins more definitely angulate in this region. Petiolar node distinctly longer than broad seen from above; anterior peduncle slightly shorter than node; a very short posterior narrowing or semi-peduncle behind node. Seen from the side, node evenly rounded above. Postpetiole very slightly longer than broad, the anterior sides approximately straight as seen from above, much as in Clark's figure of *petiolata* (1952, fig. 86). Legs and antennae with about the same inter-segmental proportions relatively as in *nigrocincta*, but all parts correspondingly a little longer and more slender, in keeping with the slightly larger and relatively more slender general body build.

Holotype worker taken in the region called locally "The Rocky Scrub," around the headwaters of the Rocky River, in the McIlwraith Range, northeast of Coen, Cape York Peninsula, Queensland (P. J. Darlington). Deposited in the Museum of Comparative Zoology.

Paratypes (Queensland Museum, Museum of Comparative Zoology). Three workers taken with the holotype and an additional three workers collected at Lankelly Creek, in the McIlwraith Range, a few miles east of Coen (P. J. Darlington). Dr. Darlington informs me that at both localities he collected most extensively in rainforest patches, although some collecting was also done in the surrounding open monsoon forest, which is very much drier. From its affinities, one would suspect that *M. flammicollis* is a rainforest species, but this is far from certain.

Variation in size in this small sample is very slight, less evident than in single nest-series of *M. nigrocincta*. The extreme lower portions of the prothorax are sometimes lightly infuscated, and mandibular dentition varies slightly in minor details. Specimens with gastric pilosity missing anteriorly are obviously rubbed. Chief variation is

in sculptural detail, especially on the pronotum. One specimen has the costulation running in an asymmetrical oblique pattern across the posterior $\frac{3}{4}$ of the pronotum; in others, the transverse costulation of the mesonotum is denser and more distinct.

This species is apparently most closely related to *M. pectiolata*, a blackish-brown species with yellow mandibles, funiculi and tarsi found in the Cairns-Bellenden Ker region of North Queensland, but differs from *pectiolata* in being even more slender and in having the pronotum colored in bright contrast to the remainder of the body. The differences from *M. nigrocineta* have already been covered; the latter species has both the pronotum and the propodeum ferruginous yellow, and the postpetiole is decidedly broader and more rounded seen from above. In Clark's key to the "nigrocineta group," given in his 1952 work (p. 110), *M. flammicollis* disagrees with both alternatives in the first couplet on account of its color. Like *M. nigrocineta*, the new species may be able to make short leaps when threatened; the color pattern marks it as a diurnal forager like the common species.

Since the presence far up on Cape York Peninsula of at least three species of *Myrmecia* (*auriventris*, *mjöbergi* and *flammicollis*) has now been demonstrated, and since the occurrence of *M. apicalis* Emery on New Caledonia is well established (despite Clark's puzzling statement of 1952, p. 112, concerning Emery's earlier footnote) it seems not at all unlikely that one or more species of *Myrmecia* may yet be found in southern New Guinea. There are, however, no safe records of *Myrmecia* coming from the Darwin area, despite search by several interested entomologists, and my questioning of aborigines in this region with alcoholic specimens at hand drew no signs of recognition of *Myrmecia*.

MYRMECIA DESERTORUM Wheeler

Myrmecia vindex var. *desertorum* Wheeler, 1915, Trans. R. Soc. S. Australia **39**: 805, worker.

Myrmecia lutea Crawley, 1922, Ann. Mag. Nat. Hist. (9) **9**: 429, worker. NEW SYNONYMY.

Myrmecia princeps Clark, 1952, Formic. Australia, Melbourne, **1**: 46-47, fig. 24, worker. NEW SYNONYMY.

Myrmecia fuscipes Clark, 1952, *Ibid.*, pp. 62-63, fig. 39, worker. NEW SYNONYMY.

This species has a blackish head and gaster; the alitrunk, nodes,

clypeus, mandibles, antennae and most often the legs are ferruginous yellow. Variation in size and in allometric characters is considerable, both inter- and intranidal, and it is very largely these differences which Clark utilizes in separating *M. desertorum*, *M. lutea*, and *M. princeps*. However, material in the Museum of Comparative Zoology, including types of *M. desertorum* and *M. lutea*, shows no such striking differences as Clark claims for them, and it seems evident that he has exaggerated, particularly in characterizing the petiole. He also depends on the density and extent of the gastric pubescence, which may be dense on the first segment, or lacking, or partly so, even in uninidal series. As with other *Myrmecia* species, this gastric pubescence is frequently deciduous, and is often lost in old or roughly handled specimens. The pronotal sculpture is also unreliable, since single nest series show the complete range of patterns linking and including *desertorum* and *lutea*. Clark's figures 24, 36, 38 and 39 will serve to demonstrate the similarity of the mandibles of *M. princeps* to those of the other three species, although Clark brings *princeps* out to a separate group in his key (p. 23) on the basis of mandibular differences. Even with the comparatively moderate amount of material available to me at present, I find the limits between these forms impossible to set.

M. fuscipes is a slightly darker form of *M. desertorum* marked chiefly by having more or less deeply infuscated middle and posterior legs. Such specimens have been examined from Port Lincoln, South Australia (A. M. Lea), which is the type locality, but even in this series I find that the legs are sometimes completely yellowish. In series from Pioneer Siding in the Dundas (Norseman) region of Western Australia (W. L. Brown), and in a dealate female from Koonalda Siding, South Australia, on the Nullarbor Plain (N. F. Wallman), the legs are consistently fuscous, but series from the Flinders Ranges of South Australia: Mt. Patawerta (A. R. Riddle) and Wilpena Pound (W. L. Brown) include specimens with both light and fuscous legs. The dark-legged form, which is most typically found nesting at the roots of chenopodiaceous desert shrubs (*Kochia*, *Atriplex*, etc.), may possibly be a southern race, but the yellow-legged form penetrates so far into its range that this seems unlikely. Until it has been studied more thoroughly, it seems preferable to consider the dark-legged form a sporadic, possibly environmentally-impressed variant without further distinction by name. The darkest specimens may have even the postpetiole strongly mottled with deep brown (Port Lincoln).

In addition to the localities mentioned already, I have seen *M. desertorum* specimens from SOUTH AUSTRALIA: Todmorden, type locality (S. A. White); Renmark, in mallee (J. G. Myers). WESTERN AUSTRALIA: Jigalong (J. Hickmer); Geraldton; Yandil (W. M. Wheeler); Corrigan (collector?); Kukerin (A. Douglas). NORTHERN TERRITORY: Ellery's Creek in the MacDonnell Ranges (S. A. White). In the north, the nest is usually excavated, with or without a small mound, under or near eucalypts. Foraging, at least in the warmer months, is strictly nocturnal.

MYRMECIA PULCHRA Clark

Myrmecia pulchra Clark, 1929, Vict. Naturalist **46**: 119, figs., worker, female.

Myrmecia fallax Clark, 1952, Formic. Australia, Melbourne, **1**: 79-80, fig. 57, worker. NEW SYNONYMY.

Myrmecia murina Clark, 1952, *Ibid.*, pp. 80-82, figs. 58-60, worker, female, male. NEW SYNONYMY.

? *Myrmecia crassinoda* Clark, 1934, Mem. Nat. Mus., Melbourne, **8**: 50, pl. 4, fig. 2, worker, female. NEW SYNONYMY WITH DOUBT.

M. pulchra, with *M. esuriens* Fabricius and perhaps one or two other species, is intermediate between the larger and smaller branches of *Myrmecia*, and combines characters of both. In the Museum of Comparative Zoology are cotypes of *M. pulchra*; and also manuscript cotypes of *M. murina* and *M. fallax*, with Clark's type labels, the last two bearing different names than those now applied; these were sent years ago to Wheeler. These agree well, allowing for the usual discrepancies and contradictions, with Clark's descriptions. Other scanty series accumulated from various sources show all degrees of intergradation linking these three forms, with intranidal variation in some cases completely bridging the *pulchra-fallax* gap. The available type of *fallax* bears a small, diffuse brownish spot mesally along the posterior border of the pronotum, but this grades through to "typical" *murina* specimens with the pronotum entirely black. Except for the color differences, which are striking enough in the extreme forms, I can see nothing of any value that can be used to separate any forms from this continuously intergradient series in which the nest series overlap broadly. The black forms (*murina*) come mostly from eastern Victoria and the Alps, while the forms with some red on the alitrunk and nodes are more characteristic of western Victoria and the Lofty Ranges of South Australia. However, the possibility that distinct eastern and

western races exist is made very unlikely by the occurrence of the extreme red form (*pulchra*) at its type locality, Cann River, which is on the southern fringe of the Alps in the south-eastern corner of Victoria. Since intergradation must have been present in the fairly extensive collections available to Clark, his failure to discuss color variation lends a spurious distinctness to the forms he has separated as species. This failure is evident in species after species throughout the 1952 work, which leads me to believe that many of the types of forms I have not been able to see are mere intergrade-linked color variants. Future Australian workers having access to the types will be able to correct this situation in the presence of adequate series showing the trends of variation. Clark's *M. crassinoda* seems, from the original description, to be merely one intermediate stage of variation in the *pulchra-murina* intergrade set, but this will have to be checked by type examination.

Material studied in addition to types, with alitrunk and nodes very nearly entirely or entirely black (*murina*): Blundell's Creek, 2600 feet, A. C. T.; Mt. Kosciusko, 4-5000 feet, New South Wales (P. J. Darlington); Mt. Buffalo, 4500 feet, Victoria (F. E. Wilson). Alitrunk with at least the posterior pronotum and entire mesonotum largely reddish, postpetiole red, black or mottled (*fallax* through *pulchra*): Grampians Ranges, Oct. 1928; Mt. William, Grampians Ranges, Victoria, Dec. 1951 (F. E. Wilson); Mt. Lofty (W. M. Wheeler), and Aldgate, South Australia (W. L. Brown). The workers have been found foraging in warm weather at midday.

MYRMECIA CARDIGASTER New name

pro Myrmecia cordata Clark, 1952, Formic. Australia, Melbourne, 1: 116, fig. 90, worker.

nec Myrmecia cordata Fabricius, 1805, Systema Piezatorum, p. 425, worker. (Dacetini).

MYRMECIA FORFICATA (Fabricius)

Formica forficata Fabricius, 1787, Mant. Ins. 1: 310, worker.

Myrmecia forficata Clark, 1952, Formic. Australia, Melbourne, 1: 93, figs. 72-74, worker, female, male, part, synonymy given.

Myrmecia brevinoda Clark, 1952, *Ibid.*, p. 96, figs. 75, 76, worker, female; *nec* Forel (see farther above under *Myrmecia brevinoda* Forel).

Myrmecia forficata var. *rubra* Forel, 1910, Rev. Suisse Zool. 18: 3, worker.
NEW SYNONYMY.

Myrmecia rubra Clark, 1952, Formic. Australia, Melbourne, 1: 98, worker; additional synonymy given.

This is the common bull-ant of the higher-rainfall areas of south-eastern Australia; it is most abundant in the Australian Alps at elevations of 1000 feet or more (higher in New South Wales), but is found at sea level in medium-rainfall sclerophyll forest in the Melbourne area and over much of Tasmania. It is sporadically distributed in the Western District of Victoria, including the moister savannah of the Camperdown district (Brown), and is common in the Lofty Ranges of South Australia (Brown). *M. forficata* has been confused by all former authors with several other species, among them *M. pyriformis*, *M. simillima*, *M. brevinoda*, and perhaps others. There is still an open problem concerning its relationship to *M. regularis* Crawley and the enigmatic *M. lucida* Forel. *M. regularis* is a southwestern Australian species with ecological requirements much like those of *M. forficata*; that is, it prefers heavy forest of the wet sclerophyll type. *M. regularis* is (in southwestern Australia) a light-to-medium reddish-brown ant with dark gaster, perhaps averaging a little smaller than the usual series of *forcifata* from the Melbourne area; the entire head, alitrunk, and especially the gaster show purplish metallic reflections that become feeble in dried cabinet material and may disappear altogether. The chief distinguishing feature of the worker is supposed to be the coloration of the gaster, in which the posterior segments are broadly banded at their apices with sordid yellowish or reddish; the apical segment is usually entirely yellow. This apical gastric pattern is also found in, and appears to be constant and specific for, some other *Myrmecia* species of different groups (*analis* Mayr, *tarsata* Fr. Smith, *tepperi* Emery, *nigriscapa* Roger) as far as investigation has gone. I am inclined to agree with former authors that it is often a constant and most useful character in the species mentioned, plus some others as well.

The difficulty with this character in the present instance, however, is that it appears in certain series from South Australia, Victoria and the Australian Alps in New South Wales which on other criteria, such as deeper color, would be placed as *forcifata*. Forel's description of *lucida*, while ambiguous, may apply to such a form from Tasmania. I found this form to be the dominant night-foraging *Myrmecia* in the wooded ravines at the western end of Kangaroo Island in 1951, but did not attach any special significance to the light-tipped gaster as a

character until I had begun this taxonomic study after my return to the United States. Since I assumed that the Kangaroo Island form was the ordinary *forcicata*, I unfortunately failed to secure any females. I say unfortunately because the females may be the key to this problem. The females of *regularis* differ from those of *forcicata* in having a much smaller thorax; Wheeler and Clark have assumed that they are "subapterous," i.e. lacking developed wings, but Haskins and Haskins (1951) found that the females may be eclosed with wings that reach to the gastric apex, but which are shed while the young queens are still virgin and callow. The colonies of *M. forcicata* frequently, probably normally, produce fully winged females capable of flight (Clark, 1952, p. 19), but these same colonies may also, according to Clark, contain various kinds of queen-worker intermediates without well-developed wings. The status of females of the *forcicata*-like form from the southeastern states with light gastric apex is not specifically mentioned by Clark, and must be presumed to be unknown. Clark (1952, p. 93) records *regularis* from Kangaroo Island and from Portland, southwestern Victoria, the records very probably being based on specimens of the *forcicata*-like (dark) form like those I found to be so common on Kangaroo Island myself, but he does not record *regularis* from the Dandenong Ranges or elsewhere in the vicinity of Melbourne despite the fact that the form in question is not uncommon in these districts where he has long resided and collected. It therefore seems very probable that Clark has confused two forms, the typical *forcicata* and the form with light gastric apex, in this area; consequently, his remarks concerning wingless females in the nests may apply to the latter. Only further collecting by someone aware of the problem beforehand will settle the status of the forms known as *forcicata-lucida-regularis*.

The problem is made less easy by the fact that *M. forcicata* (with concolorous blackish gaster) throws light reddish-colored variants in Victoria and elsewhere in the southeastern states; like the typical *forcicata* (and *regularis*), these light variants frequently show violet, blue or green metallescence in fresh specimens, particularly on the gaster where the background color is darker. To these variants, the names *rubra*, *violacea* and *brevinoda* (*nec* Forel) have been applied, and slight differences in petiolar shape have been supposed also to distinguish them. The petiolar differences seem to have been over-emphasized by Clark, and his figures of the petioles of the different forms are somewhat ambiguous and contradictory in different views.

In my own collecting in the region around Melbourne and various other localities from which Clark records these forms, I have found the light-colored variants, but I have been unable to establish any constant differences in petiolar form; the variation in petiolar shape is slight but distinct within each nest series, and appears to be at least partly an allometric feature, but each series seems to vary in just about the same way. The color difference is not so extreme when one takes into account the possibility that certain broods may not have attained full adult color in some cases; intranidal color variation is often considerable at midsummer and perhaps other periods of the year. I believe that these forms will have to be considered as straight *forcicata* until proof is forthcoming that they are anything else.

As mentioned above, *forcicata* (and also *regularis*) is primarily a nocturnal forager. Workers may leave the nest some time before dusk and remain out after sunrise, and occasionally one may see them out on dark, rainy or cool days, but all of my numerous observations indicate strongly that the greatest force of workers is outside the nest during the hours of total darkness when the weather is warm enough. On warm summer nights, I have found that the forests where they occur may be swarming with them, far more workers being visible under a hand electric torch than are ever seen abroad during daylight. I find that this fact is well known to people who have slept out often in the bush, but it has been little appreciated by previous writers on *Myrmecia*, who either, like Clark, maintain flatly that all *Myrmecia* are daylight foragers, or else state the facts in an ambiguous and perfunctory way.

I have noted wherever possible the foraging activities of *Myrmecia* with respect to diurnation, and I believe that I can state with confidence that many species are strictly diurnal foragers, some, like *M. desertorum*, normally completely nocturnal, and a large number either predominantly nocturnal or predominantly crepuscular. Furthermore, there seems to be a more or less definite correlation between the worker color pattern and diurnation: those species having (a) black coloration with prominent yellow mandibles, antennae and fore tarsi; (b) bold patterning of red and black; or (c) conspicuous golden or orange pubescence on the gaster, sometimes in combination with (a) or (b) patterns, are predominantly or entirely diurnal foragers, so far as I have seen. Examples in which I have been able to observe diurnal foraging at or near midday in bright, warm weather include: *auriventris*, *pilosula*, *piliventris*, *mandibularis*, *gulosa*, *nigriscapa*,

varians, *?harderi*, *nigrocincta*, *pulchra*, *tarsata*, and others. The nocturnal-crepuscular species lack brilliant metallic pubescence (so far as I am aware) and are generally colored in dullish reds, browns or yellows; the color in *desertorum*, with its usually dark brownish head and gaster and often rather light yellow alitrunk, while appearing rather strikingly contrasted, is nevertheless not at all like any of the red-and-black arid-country day foragers, and the yellowish coloration of the alitrunk may reflect a degree of metabolic conservatism affecting the pigment, for this species is certainly very markedly nocturnal as I have seen it at widely separated localities in South and Western Australia. Species figuring strongly as nocturnal foragers in my notes, in addition to the *forficata* complex, are: the "red phase" of *simillima* (perhaps more crepuscular), *brevinoda* (= *gigas*), *nigriceps*, *pyriformis*, *mjöbergi*, *vindex* or closely related species, Esperance district of Western Australia, and *analis* (crepuscular).

I believe that the bright colors of the day-foraging forms are of the warning type (as in diurnal Mutillidae); the (a) type of coloration may also function as an inter-individual recognition pattern, though this is purely speculative and has not been borne out by tests made on *pilosula* by Haskins (*in litt.*), wherein the color pattern of mandibles, antennae and fore tarsi were modified by adding pigments, etc. Such a recognition pattern might operate best in the case of foraging individuals among flowers and foliage where the prey is stalked. The warning coloration hypothesis, however, seems very likely to hold for the day-foraging species even though observations on predators that might be affected are scarcely begun.

In a recent comprehensive paper, Haskins and Haskins (1951) add a great deal of new material to the biological knowledge of several *Myrmecia* species, and their work should be consulted by anyone interested in formicid biology. Unfortunately, the "Background" section of this paper contains some misstatements of fact (often following earlier statements of Clark), particularly concerning the geographical and ecological distribution of the genus, and the authors appear to support Clark's "excellent general habit notes" in spite of the fact that Clark's notes are often strongly in error and are neither extensive nor very general, considering his excellent opportunities for making a detailed study. It has also been determined that some of the Haskins' observations suffer from taxonomic confusion of closely related species, particularly as regards the smaller-sized workers and their foraging activities. I have found that, in nature at least, the

smallest workers of populous nests of several species rarely or never forage outside the nest. This fact, once appreciated, leads to a reopening of the whole question of possible trophallaxis in *Myrmecia*; the Haskins team has undertaken a new investigation of this question and has come up with results that will force a modification of their views of 1951. With publication of their results, it is hoped that a new review of myrmeciine biology, correcting previous errors and providing an accurate summary of knowledge of the tribe, will be forthcoming.

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